Scioto Edit

Physical Science

Key

Semester One Exam Review Guide

PART 1-MOTION

1. **Define/provide examples of/provide conditions for/describe applications of the following:**

Frame of Reference - a system of objects that are not moving with respect to one another

Position - an object's distance and direction from a reference point.

Distance - the length of the path between two points (total)

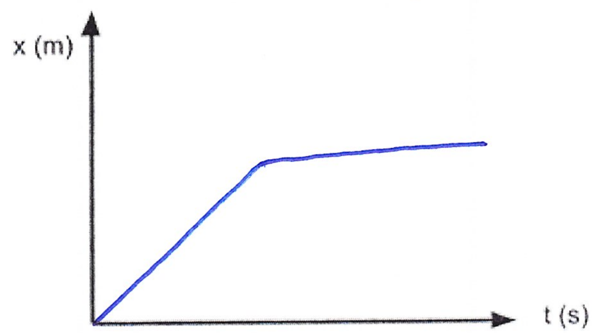
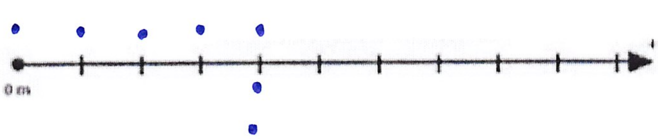
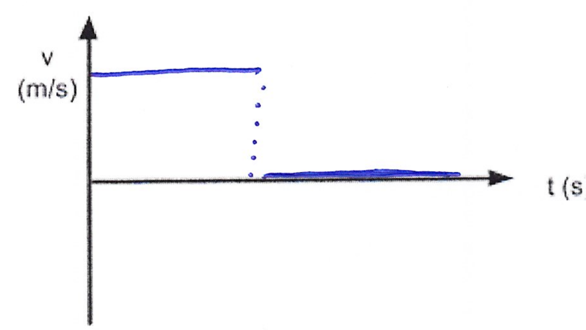
Displacement - the distance from the end point to the original origin/starting pt.

Speed (w/ units) - the ratio of the distance an object move to the amount of time the object moves ($s = d/t$) (m/s)

Velocity (w/ units) - the speed and direction and object is moving, measured relative to the reference point. ($v = x/t$) (m/s)

Acceleration (w/ units) - the rate of change in velocity ($a = \frac{v_f - v_i}{t}$) → (m/s^2)

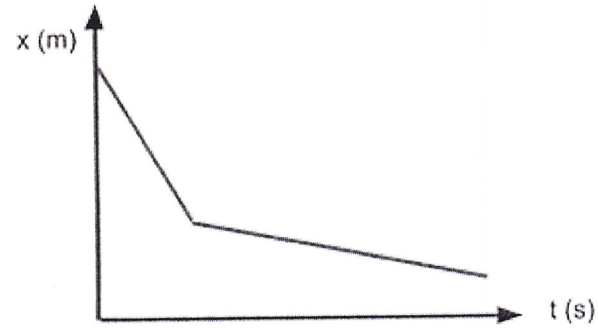
2. **Given the information, complete the other representations for the given's motion.**

Written Description of motion:	**Position vs. Time graph:**
Object moves a constant velocity in the positive direction (away), the stops moving for a few seconds.	
Motion Map:	**Velocity vs. Time graph:**
	

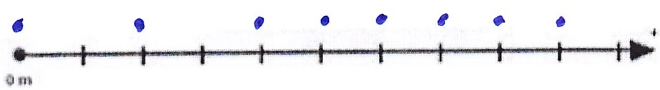
Written Description of motion:

An object starts away from the origin, it walks a constant velocity towards the origin. After a few seconds the object slows its velocity to a new slower constant velocity.

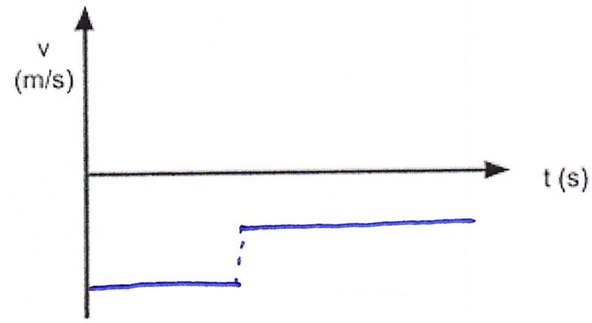
Position vs. Time graph:



Motion Map:



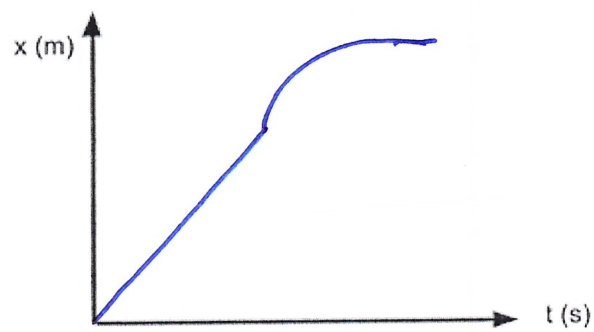
Velocity vs. Time graph:



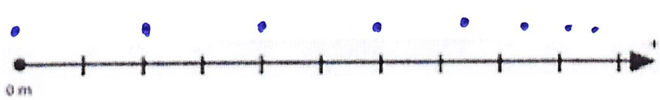
Written Description of motion:

An object begins walking away from the origin at a constant velocity. After a few seconds the object accelerates negatively, until the object come to a rest.

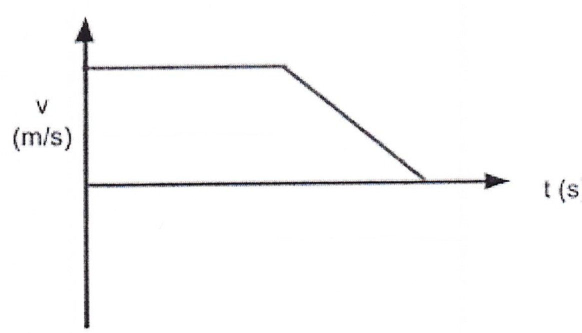
Position vs. Time graph:



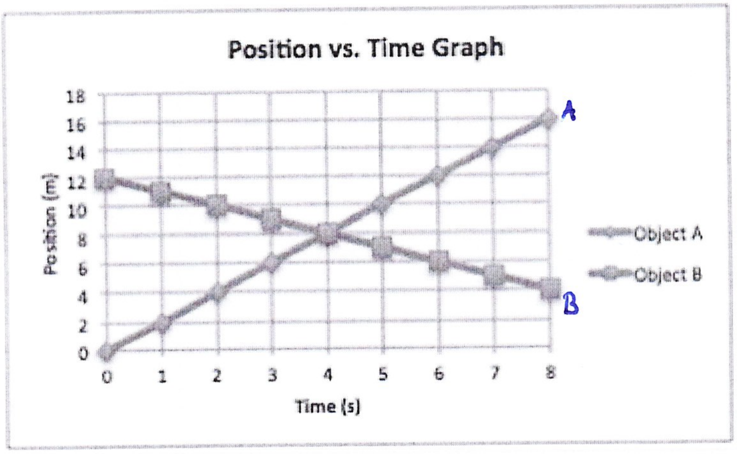
Motion Map:



Velocity vs. Time graph:



3. **Given the Position vs. Time graph answer the following questions.**



slope of $\frac{x}{t} = v$

Which object had the greater displacement? Explain.

Object A

What are the velocities for Objects A and B?

Obj A: $\frac{16-0}{8-0} = \boxed{2 m/s}$

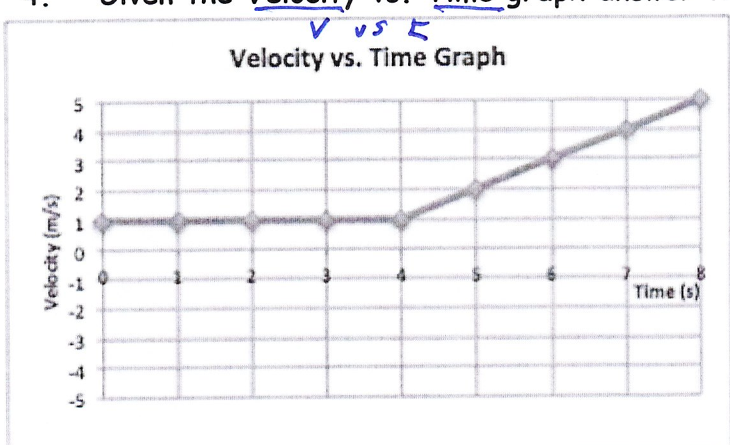
obj B: $\frac{12-4}{8-0} = \frac{8}{8} = \boxed{-1 m/s}$

What are TWO differences in the motion of Objects A and B?

ObjA = Postive Velocity
objB = negative Velocity

4. **Given the Velocity vs. Time graph answer the following questions.**

V vs t



$a = \frac{\Delta V}{\Delta t} = \frac{V_f - V_i}{t}$

Describe the object's motion from t=0s to t=4s.

Describe the object's motion from t=4s to t=8s.

0-4s → object is moving at a const velocity of 1m/s

4-8s → object is accelerating (+)

What is the acceleration of the object from t=0s to t=4s? What is the acceleration of the object from t=4s to t=8s?

0-4s ⇒ accel = $\boxed{0 m/s^2}$

4-8 → $a = \frac{V_f - V_i}{t}$ → $\frac{5-1}{4} = \frac{4}{4} = \boxed{1 m/s^2}$

Give one similarity and one difference in the object's motion during t=0s to t=4s and t=4s to t=8s.

sim → Both in Positive direction

dif → const vs. Accel

PART 2-FORCES and NEWTON'S LAWS

5. **Define/provide examples of/provide conditions for/describe applications of the following:**

Force (w/units) - A push or a pull that acts on an object. F=ma (N)

Balanced Force - When forces are equal in magnitude (amount), but in opposite directions (Net Force = 0N)

Unbalanced Force - When forces are not equal in magnitude (amount). (Net force ≠ 0)

Net Force - The overall (Total) force acting on an object after all the forces are combined.

Force diagram/Free body diagram - A Diagram/Picture of all the force (Labeled w/ units)

Adding/Subtracting forces - ANS can be positive or negative (depending on direction)

Friction - A force that opposes motion

Gravity/gravitational force - Force pull due to gravitational pull on a mass [on Earth = 9.81 m/s^2]

Normal force - The reaction Force to the pull of gravity (etc).

Tension force - The reaction Force caused by the pull of gravity on a object connect to a spring.

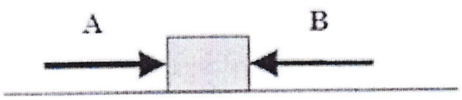
Applied force - The force that is caused/generated on an object

Drag/air resistance - Fluid friction acting on an object moving through the air.

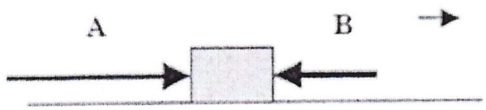
Inertia - "Lazy" The tendence for an object to resist a change in motion.

6. **Force Diagrams:**

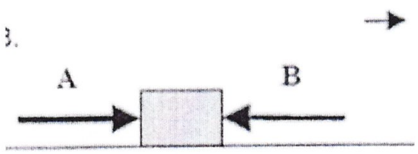
For each diagram below, the large arrows represent the forces and the small arrows (if any) represent the direction of motion. Circle the word balanced or unbalanced and then circle to indicate if the motion of the box is at constant velocity or accelerating.



Forces: *Balanced* *Unbalanced*
Motion: *Constant Velocity* *Accelerating*



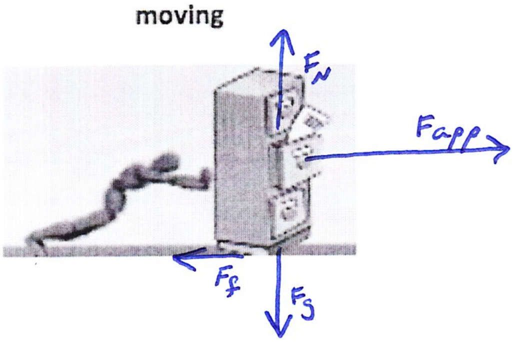
Forces: *Balanced* *Unbalanced*
Motion: *Constant Velocity* *Accelerating*

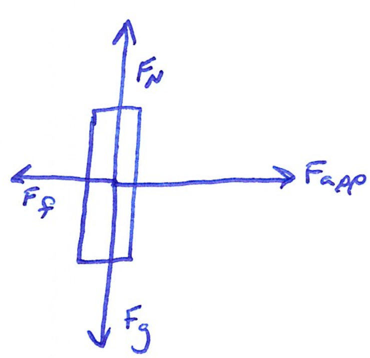


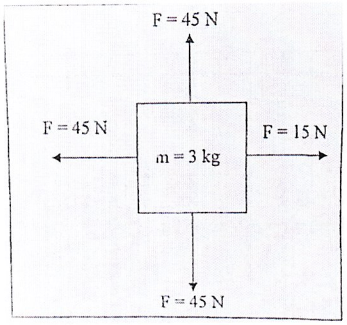
Forces: *Balanced* *Unbalanced*
Motion: *Constant Velocity* *Accelerating*

7. In the space to the right, draw and label the forces on a force diagram in the following situation in which Joe pushes a cabinet and it accelerating:

Joe pushing and cabinet moving







8. For the diagram to the left, identify the net force and the acceleration of the 3 kg object.

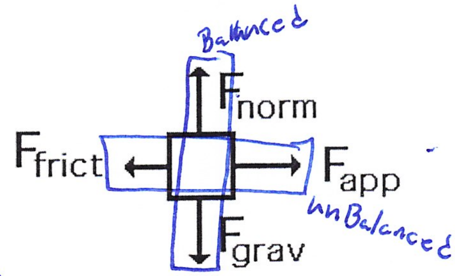
Net Force: $F_{Net} = [(45) + (-45) + (15) + (-45)] =$ **-30N to the Left**

Acceleration: $F = ma$

$\frac{-30}{3} = \frac{3(a)}{3}$ → $-10 = a$ → **-10 m/s²**

9. For the diagram to the right, identify...
   - which forces are balanced and which forces are unbalanced. How do you know from the diagram that there are balanced and unbalanced forces?

     size of the arrows.



$F_{norm} + F_{grav} = B$

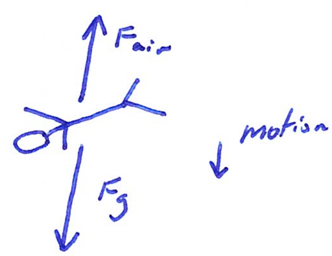
$F_{frict} + F_{app} = UB$

   - if the object in the diagram (the box) is [it] in motion? If yes describe its motion.

     yes, accel to the right.

10. Describe and sketch a situation (w/ force diagram) in which forces are balanced, and an object is moving at a constant velocity.

Terminal velocity



Indicate which of Newton's Three Laws is best described in each of the following situations:

11. A diver dives forward off of a raft. The raft moves backward 3rd Law (Action = Reaction)

12. You are standing on a bus moving down the street. The bus suddenly stops. You "fly" forward.
1st Law (Inertia)

13. A gently tossed football travels slower than one that is strongly thrown
2nd Law (F=ma)

Force Calculations:

15. What is the mass of an object that requires 150 N of force to accelerate it at 30 m/s/s?

$F = 150N$ $\quad F = ma$
$m = ?$ $\quad \frac{150}{30} = \frac{m(30)}{30}$ → **5 kg**
$a = 30 m/s^2$

16. What is the acceleration of a 2500 kg truck if a force of 7500 N is applied?

$F = 7500 N$ $\quad F = ma$
$m = 2500 kg$ $\quad \frac{7500}{2500} = \frac{2500(a)}{2500}$ → **$3 m/s^2$**
$a = ?$

17. How much force should a soccer player apply to cause 0.5 kg ball to accelerate at a rate of 20 m/s/s?

$F = ?$ $\quad F = ma$
$m = 0.5 kg$ $\quad F = (.5)(20)$
$a = 20 m/s^2$ $\quad F = 10$ → **10N**

PART 3-ENERGY

18. Define/provide examples of/provide conditions for/describe applications of the following:

Law of Conservation of Energy - Energy can not be created or distroyed (on transfered)

Joule - unit for energy (= to a Newton meter)

Kinetic Energy [E_K] (w/formula) - Energy in motion ($KE = \frac{1}{2}mv^2$)

Gravitational Potential Energy [E_g] (w/formula) - Stored Energy ($PE = mgh$)

Mechanical Energy [EM] (w/ formula) - "Total Energy" ($ME = KE + PE$)

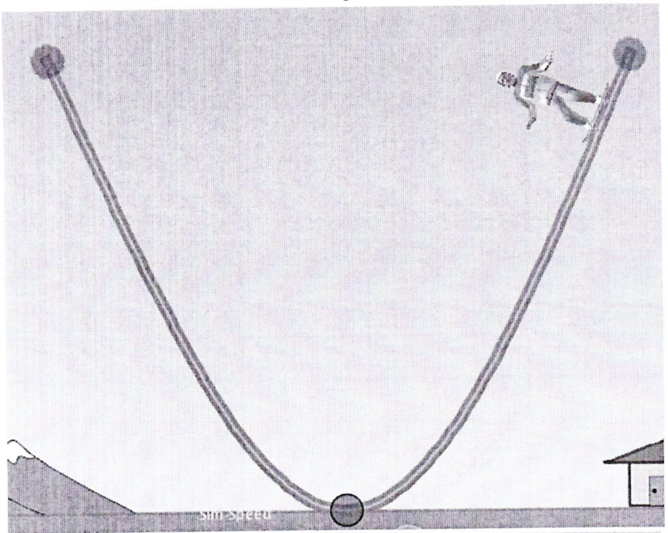
Current (w/units) - The "Flow" of electrons / Energy in an circuit! (Amps)

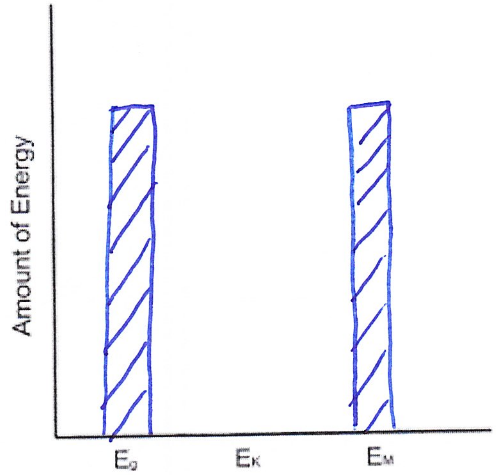
Voltage (w/units) - The potential difference in a circuit. The Push. (volts)

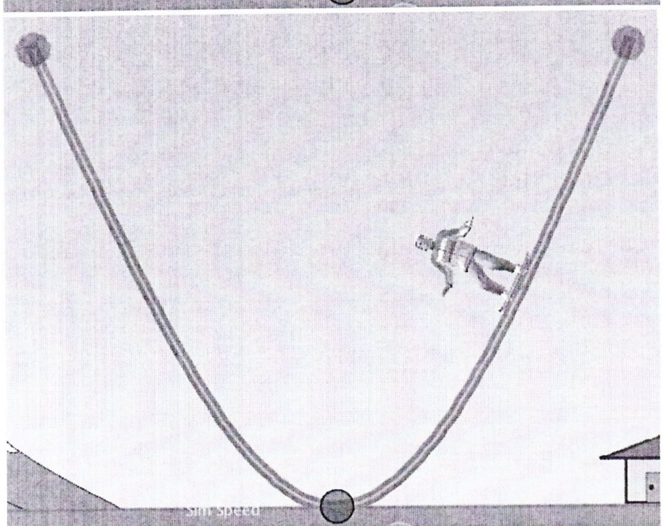
Resistance (w/units) - The opposition of current in a circuit (ohms Ω)

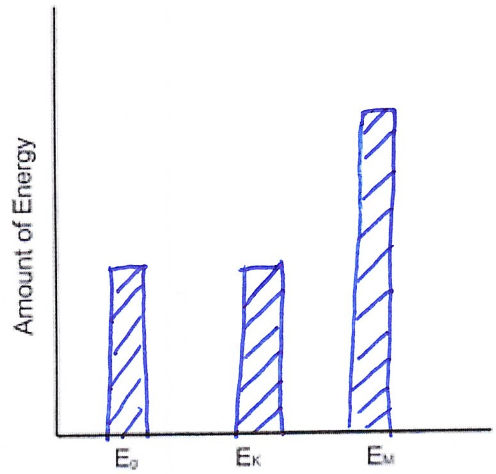
Work (w/ formula & units) - A Force that is applied in the same direction as motion. ($W = F \cdot d$)

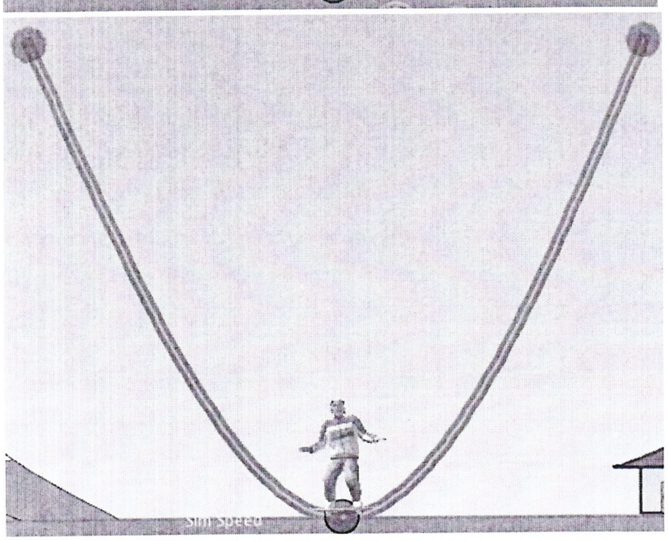
19. Given the following scenario, fill-in the energy bar charts for the skater's motion.

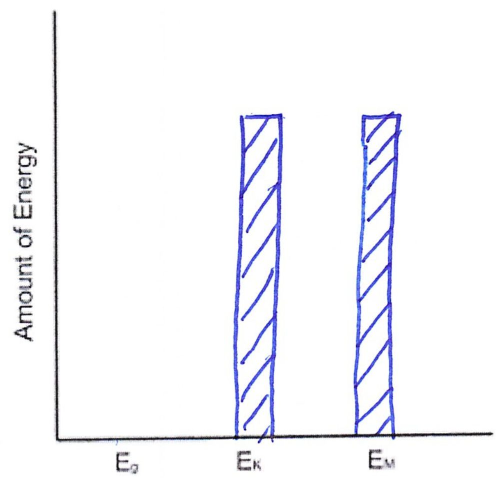












20. Determine the kinetic energy of a 625-kg roller coaster car that is moving with a speed of 18.3 m/s.

Known & Unknown Variables

$m = 625 kg$

$v = 18.3 m/s$

$KE = ?$

Equation(s)/Formula(s) Used

$KE = \frac{1}{2}mv^2$

Calculations (with units on ALL #'s)

$KE = \frac{1}{2}mv^2$

$KE = \frac{1}{2}(625)(18.3^2)$

$KE = 104,653.13 J$

Answer

21. A cart is loaded with a brick and pulled at constant speed along an incline to the height of 0.45 meters. If the mass of the loaded cart is 3.0 kg what is the gravitational potential energy of the loaded cart at the top of the incline?

Known & Unknown Variables

$h = 0.45 m$ $GPE = ?$

$m = 3.0 Kg$

$g = 9.81 m/s^2$

Equation(s)/Formula(s) Used

$GPE = mgh$

Calculations (with units on ALL #'s)

$GPE = (3)(9.81)(0.45)$

$GPE = 13.24 J$

Answer

22. If a force of 14.7 N is used to drag the loaded cart (from Question 21) along the incline for a distance of 0.90 meters, then how much work is done on the loaded cart?

Known & Unknown Variables

$F = 14.7\ N$ $\quad W = ?$

$d = 0.90\ m$

Equation(s)/Formula(s) Used

$W = F \cdot d$

Calculations (with units on ALL #'s)

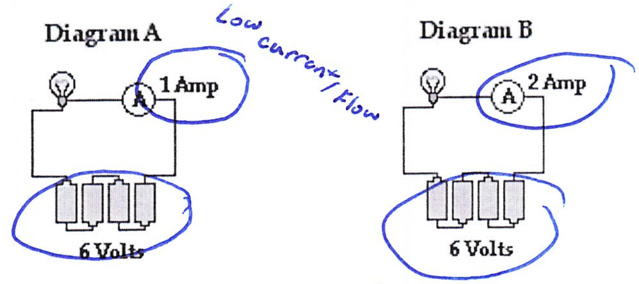
$W = F \cdot d$

$W = 14.7(.9)$

$W = 13.23\ J$

Answer

23. The diagram below depicts a couple of circuits containing a voltage source (battery pack), a resistor (light bulb) and an ammeter (for measuring current). In which circuit does the light bulb have the greatest resistance? Why?



= Lowest Flow!

Diagram A

it has the same volt, but Lowest Flow (current). Thus $\Omega = \uparrow$.

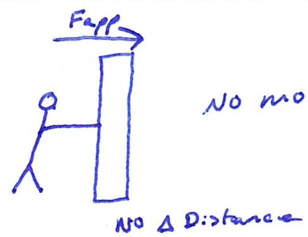
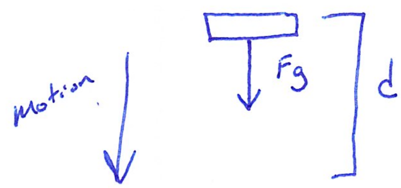
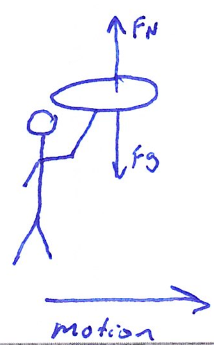
24. Which of the following will cause the current through an electrical circuit to decrease? Cirlce all that apply.

- decrease the voltage
- decrease the resistance
- increase the voltage
- increase the resistance

25. A certain electrical circuit contains a battery with three cells, wires and a light bulb. Which of the following would cause the bulb to shine less brightly? Circle all that apply.

- increase the voltage of the battery (add another cell)
- decrease the voltage of the battery (remove a cell)
- decrease the resistance of the circuit
- increase the resistance of the circuit

26. Read the following statements and determine whether or not they represent examples of work and then provide an explanation for your answer.

Scenario	Example of Work (Y/N)	EXPLANATION
A teacher applies a force to a wall and becomes exhausted.	No	 No motion = No WORK
A book falls off a table and free falls to the ground.	yes	 Force and motion are in same direction = Work.
A waiter carries a tray full of meals above his head by one straight across the room. (Think only about the work of the server on the tray)	NO	 Force and Motion are not in same direction = No Work